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Effect of unripe berline banana flour on synbiotics yogurt of physicochemical and microbiological properties

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ABSTRAK

Latar Belakang: *Yoghurt sinbiotik tergolong dalam produk susu fermentasi yang mengkombinasikan antara bakteri probiotik dengan bahan yang mengandung komponen prebiotik. Tepung pisang berlin mentah memiliki kandungan pati resisten yang dapat berperan sebagai prebiotik..*
Tujuan: *Penelitian bertujuan untuk mengetahui pengaruh penambahan tepung pisang berlin mentah pada yogurt sinbiotik terhadap properties fisikokimia dan mikrobiologi.*
Metode: *Penelitian ini merupakan penelitian True Experimental dengan rancangan acak lengkap. Kelompok perlakuan terdiri atas 4 kelompok yakni P0 (inulin 2%), P1 (UBF 1%), P2 (UBF 2%), dan P3 (UBF 3%). Proses pembuatan yoghurt sinbiotik tepung pisang berlin mentah yaitu diawali dengan membuat tepung pisang berlin, starter yogurt, dan yogurt sinbiotik. Uji yang dilakukan yakni uji fisikokimia dan mikrobiologi. Data uji fisikokimia dianalisis secara deskripitif dan uji mikrobiologi dianalisis menggunakan kruskall walls dengan taraf 95% menggunakan SPSS.*
Hasil: *Pada uji fisikokimia diketahui bahwa pada kelompok dengan penambahan UBF (P1, P2, P3) memiliki kadar abu, energi, pati resisten, dan viskositas yang lebih tinggi dibandingkan kelompok inulin (P0). Pada uji mikrobiologi diketahui bahwa terdapat perbedaan signifikan total BAL antar kelompok perlakuan (P=0.002), tidak terdapat perbedaan terkait parameter koliform antar kelompok (P=0,707), dan salmonella teridentifikasi negative pada semua kelompok.*
Kesimpulan: *Penambahan tepung pisang berlin mentah dapat mempengaruhi kandungan BAL dalam yogurt dan berpotensi sebagai produk pangan fungsional yang bermanfaat bagi kesehatan.*

KATA KUNCI*: fisikokimia; mikrobiologi; pati resisten; UBF; yogurt sinbiotik*

ABSTRACT

Background: *Synbiotic yogurt is a fermented milk product that combines probiotic bacteria with ingredients that contain prebiotic components. Unripe berlin banana flour contains resistant starch that can act as a prebiotic.*

Objectives: *This study aimed to determine the effect of the addition of unripe banana flour to synbiotic yogurt on physicochemical and microbiological properties.*

Methods: *This research is true experimental with a completely randomized design. The treatment group consisted of 4 groups, namely P0 (2% inulin), P1 (1% UBF), P2 (2% UBF), and P3 (3% UBF). The process of making unripe berlin banana flour synbiotic yogurt begins with making berlin banana flour, yogurt starter, and synbiotic yogurt. The tests conducted were physicochemical and microbiological. Physicochemical test data was analyzed descriptively and microbiological tests were used the Kruskall walls test, with 95% level confidence using SPSS.*

Results: *In the physicochemical test, it was found that the group with the addition of UBF (P1, P2, P3) had higher ash content, energy, resistant starch, and viscosity than the inulin group (P0). In the microbiological test, it was found that there were significant differences BAL total between treatment groups (P=0.002), there were no differences related to coliform parameters between groups (P=0.707), and salmonella was identified as negative in all groups.*

Conclusions: *The addition of unripe berlin banana flour can affect the LAB content of yoghurt and has the potential to be a functional food product with health benefits.*

KEYWORD*:* *physicochemistry; microbiology; resistant starch; UBF; synbiotic yogurt*

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INTRODUCTION

Synbiotic yogurt is classified as a fermented milk product that combines probiotic bacteria with ingredients that contain prebiotic components. Synbiotic yogurts have the potential to improve health outcomes and the ability to prevent and control chronic diseases via a synergistic effect between probiotic bacteria and prebiotic compounds (1). The current development of yogurt is used as an alternative functional food to meet the needs of people who want to have a healthy life easily. Functional food is processed food that contains one or more functional components, which based on scientific studies, have certain physiological functions, proven not harmful and safe for health. Synbiotics aim to stimulate the growth or activity of Bifidobacteria and Lactobacilli by using carbohydrates with several probiotic starches. The advantage of this combination is that it increases the survival of probiotic bacteria because specific substrates are available for fermentation so that the body benefits more fully from the combination (2). The production of synbiotic yogurt is generally done by using lactic acid bacteria that function as probiotics, such as Bifidobacterium bifidum, Lactobacillus casei, or Lactobacillus acidophilus with the objective of improving the quality and added value of yogurt as a health drink (3). Prebiotics are indigestible food components that support beneficial bacteria (4). Resistant starch (RS) has a high prebiotic capacity because it is an indigestible carbohydrate, but it has a favorable influence on the probiotic microflora environment in the gut, thus providing health effects for humans (5).

Unripe banana flour is a food ingredient that contains prebiotics. Unripe banana flour supports the growth of probiotic bacteria that are resistant to α-amylase and trypsin hydrolysis (6). The resistant starch (RS) content in unripe banana flour is a natural source that contributes to the development of prebiotics (7). RS is a plant prebiotic classified as a type of dietary fiber that can modulate gut health in humans and has clinically beneficial effects on colon health (8,9). Dietary fiber is a source of energy for microbiota

activity that plays a role in maintaining colon health (10). The analysis of unripe berlin banana flour contained 40.01% RS from 100 g of flour, while ripe berlin banana flour contained 39.76% (11). RS as a soluble fiber has potential as a prebiotic due to its ability to resist digestion pass through the colon and positively stimulate fermentation of the gut microbiota. RS also stimulates hormones that play a role in appetite control, preventing fat accumulation and thus aiding in weight management (12). Synbiotic yogurt with the addition of unripe berlin banana flour which has RS content is beneficial as a prebiotic that is beneficial to health. The purpose of this study is to analyze the effect of the addition of unripe Berlin banana flour on total lactic acid bacteria (LAB), RS content, and acceptability of synbiotic yogurt with the addition of unripe berlin banana flour.

MATERIALS AND METHODS

This research was conducted at the Dietetics Laboratory, Clinical Nutrition Study Programme, Jember State Polytechnic. In addition, the research was also conducted in the Analysis Laboratory at the Food Industry Technology Study Programme, Jember State Polytechnic and Microbiology Laboratory, FMIPA, University of Jember. The research was conducted in July-August 2023. The type of banana used in this study is the Berlin banana. The main ingredients used in this study were unripe banana flour (UBF), skimmed milk, sugar, and inulin, and the starter used was Maltodextrin and active bacterial cultures (Bifidobacterium longum, Lactobacillus rhamnosus, Lactobacillus casei, Lactobacillus helveticus, Lactobacillus bulgaricus, Lactobacillus acidophilus, Streptococcus thermophilus).

This research is True Experimental research with a completely randomized design. The treatment groups consisted of P0 (synbiotic yogurt with the addition of inulin), P1 (synbiotic yogurt with the addition of UBF 1%), P2 (synbiotic yogurt with the addition of UBF 2%), and P3 (synbiotic yogurt with the addition of UBF 3%). The process of making unripe berlin banana flour synbiotic yogurt begins with making berlin banana flour with the manufacturing process, according to Putri Damayati et al., 2020 (13). Furthermore, make a yogurt starter by dissolving 125 grams of powdered skim milk into 1 L of warm water at 45oC. A dry yogurt starter of as much as 3 grams was put into a warm sterile milk solution, which was then incubated for 24 hours in a closed container. The next stage is the preparation of unripe Berlin banana flour synbiotic yogurt by preparing unripe Berlin banana flour first with the following percentages: P0 = 2% Inulin, P1 = 1% unripe banana flour, P2 = 2% unripe banana flour, and P3 = 3% unripe berlin banana flour. Prepare 13 grams of skimmed milk and 2.5 grams of sugar, then mix and dissolve with water up to 100 mL and heat to a temperature of 80°C, after cooling to 45°C, inoculate with yogurt starter as much as 3 mL for each treatment. Each treatment was then incubated at 42°C for 12 hours.

Analysis of ash, fat, protein, carbohydrate, and resistant starch using standardized analysis methods in SNI 01-2891-1992. Total energy analysis refers to SOP number 13/PL17.3.03/SOP/2021, viscosity SOP number 4/PL17.3.2.03/SOP/2021, Total acid, pH analysis refers to SNI 2973-2011. The lactic acid bacteria analysis test uses the spread plate method, the coliform test uses the 3-tube APM method, while the salmonella test uses the salmonella selective media test.Physicochemical test data were analyzed descriptively and microbiological tests were analyzed using Kruskall walls and continued with the Whitney test with a 95% confidence level.

RESULTS AND DISCUSSIONS

The ash content of P0, P1, P2, and P3 were 0.97%, 1.05%, 1.14%, and 1.21%, respectively. The mineral content present in food products can also affect the assessment of the ash content of the product. The most mineral content found in bananas is potassium (14).

The fat content in all treatment groups is in accordance with the product standards yogurt, the fat content of min 3%. Group P3 has lower fat content than other groups. In unripe bananas, the fat content is known to be 0.18% (15). The results of the analysis of fat content in unripe berlin banana flour were 1.07% (16). Functional foods that utilize the presence of prebiotics effect to improving the fatty acid profile (17).

The protein content in the table above shows that all treatment groups are in accordance with the protein content standards set by SNI 2891: 2009, which is a minimum of 2.7%. The P1 group

had higher protein levels compared to the P2 and P3 groups. The carbohydrate content of P2 is at a higher level than the other groups. The carbohydrate source in the sugar content is inulin in P0 and unripe banana flour in P1, P2, and P3. All yogurt formulations use 2.5 g/100 ml of sugar, which fulfills the claim of low-sugar yogurt products (18).

Inulin is a type of carbohydrate that acts as a prebiotic (19). The carbohydrate content of unripe berlin banana flour is 82.6% per 100 g flour (16). The total energy of the yogurt was below the calorie requirement of yogurt per serving, which is less than 120 kcal/ serving (20).

Total acid in all groups had values around 0.78%-0.93%, and these values were in accordance with the SNI quality requirements with a range of values of 0.5%-2% (21). LAB activity ferments the presence of fiber in unripe banana flour as an energy source, which will produce lactic acid. The fermentation activity carried out by LAB during yogurt making causes the accumulation of lactic acid products produced so that the value of total acid titration can increase (22).

Table 1. Physicochemical properties of unripe berlin banana flour symbiotic yogurt

Paramaters	Groups (Mean ± SD)				Quality Reqirements SNI
	P0	P1	P2	P3	
Ash (%)	0.97±0.03	1.05±0.03	1.14±0.04	1.21±0.04	Max 1.0%
Fat (%)	3.33±0.04	3.30±0.00	3.25±0.00	3.23±0.04	Min 3.0%
Proteins (%)	3.81±0.08	3.75±0.06	3.64±0.06	3.23±0.04	Min 2.7%
Carbohydrate (%)	5.47±0.37	5.74±0.01	5.93±0.14	3.59±0.03	-
Energy (kcal/100g)	67.03±1.52	67.14±0.57	67.53±0.34	68.51±0.71	-
Total Acid (%)	0.93±0.03	0.88±0.01	0.82±0.03	0.78±0.04	0.5%-2%
Resistant Starch (%)	2.47±0.05	2.59±0.03	2.61±0.09	2.77±0.03	-
Viscosity (mm/s)	0.25±0.00	1.03±0.04	0.73±0.04	0.50±0.00	-
pH	3.93±0.01	3.96±0.01	2.61±0.09	4.02±0.01	3.80-4.50

Figure 1. The pocketbook is used as the media for counseling in this present study. This book consists of several chapters, namely 1) what is metabolic syndrome; 2) what are the signs and symptoms of metabolic syndrome; 3) metabolic syndrome evidence in Indonesia; and 4) how diet can prevent and manage metabolic syndrome

The most resistant starch was found in the P3 group. The greater the addition of unripe banana flour, the greater the resistant starch content. Resistant starch (RS) in unripe bananas has the potential to act as a prebiotic due to its ability to resist digestion and pass through the colon, positively stimulating gut microbiota fermentation (12). The lowest viscosity was found in the P0 compared P1, P2, and P3 groups. Banana flour contains pectin, which can increase the viscosity of yogurt (23). Pectin is a hydrocolloid that can bind water strongly, with this strong water-binding ability, it will reduce syneresis in yogurt (24).

The highest pH value of yogurt was obtained in P3 with a value of 4.02, while the lowest pH value was in P2 with a pH value of 2.61 According to SNI 2009, good yogurt quality requirements have a pH value ranging from 3.80-4.50. In the results, it is known that the P0, P1, and P3 groups meet the quality requirements of yogurt.

Table 2. Microbiology properties of unripe berlin flour symbiotic yogurt

Paramaters	Groups (Mean ± SD)				P Value	Quality Requirements SNI
	P0	P1	P2	P3		
BAL Total (10^7CFU/ml)	1.25^{a}	8.6^{b}	4.65^{ab}	0.70^{a}	0.002	Min 10^7
Coliform (APM index/ml)	19^{a}	7^{a}	23^{a}	32^{a}	0.707	Max 10
Salmonella	negative	negative	negative	negative	negative	Negative/25g

Notes: The different superscripts within the same row showedsignificant difference (P<0.05)

Based on the analysis of the number of lactic acid bacteria (LAB) in unripe banana flour synbiotic yogurt, it is known that there are differences between treatment groups p=0.002. Group P1 had a greater number of LAB compared to the other groups. The higher the addition of unripe berlin banana flour in the synbiotic yogurt product, the less the amount of LAB. The results of coliform testing on yogurt products showed no significant difference p=0.707. Group P1 is known to have a coliform result of 7 and is in accordance with the quality requirements of yogurt in SNI 2891: 2009, which is a maximum of 10. Salmonella test showed negative results in all treatment groups. This condition is in accordance with the quality requirements of yogurt in SNI 2891: 2009, which is negative. Salmonella bacteria are inhibited through the process of making synbiotic yogurt by pasteurization with a temperature of about 80oC. In addition, the presence of Lactobacillus acidophilus bacteria is known to have a role in inhibiting the growth of pathogens such as Salmonella (25).

CONCLUSIONS AND RECOMMENDATIONS

The addition of unripe berlin banana flour can affect the LAB ($p<0.05$) and has the potential to be a functional food product with health benefits.

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